

What is claimed is:

1. An implantable beneficial agent infusion device, comprising:
  - an hermetically sealed enclosure;
  - a fluid reservoir positioned at least partially within the hermetic enclosure, the fluid reservoir being adapted to contain a fluid containing a beneficial agent therewithin;
  - means for delivering the fluid into a patient's body;
  - a controllable pump, the pump communicating with the reservoir and the means for delivering the fluid into a patient's body and causing the fluid to move from the reservoir into the means for delivering a fluid into a patient's body upon receiving a command actuating same; and
  - a valve assembly comprising a deflectable energy storing member, means for controllably energizing and deflecting the energy storing member by providing an output voltage and electric charge thereacross or therein, and means for recovering the electric charge from the deflectable energy storing member when the output voltage provided thereto is switched off.
2. The implantable medical device of claim 1, wherein the energizing and deflecting means is electrically coupled to upper and lower surfaces of the deflectable energy storing member.

3. The implantable medical device of claim 1, wherein the energy storing member is deflectable or moveable between a first non-energized position in which movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is blocked, and a second energized position in which the movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is permitted.

4. The implantable medical device of claim 1, wherein the energy storing member pushes or pulls a seal between a first sealed position in which movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is blocked, and a second unsealed position in which the movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is permitted, when the member is de-actuated and actuated, respectively.

5. The implantable medical device of claim 1, wherein the deflectable energy storing member comprises a piezo-electric material.

6. The implantable medical device of claim 1, wherein the deflectable energy storing member comprises an electro-capacitive material.

7. The implantable medical device of claim 1, wherein the deflectable energy storing member comprises an electro-static material.

8. The implantable medical device of claim 1, wherein the deflectable energy storing member comprises a solenoid.
9. The implantable medical device of claim 1, wherein the fluid reservoir further comprises means for maintaining the fluid containing a beneficial agent between a first pressure and a second pressure.
10. The implantable medical device of claim 1, wherein an integrated circuit comprising a driving circuit receives electrical current from a power source and transforms the current into an output signal appropriate to cause the energy storing member to deflect in response to the application of an electrical field thereto such that a sealing means moves into an open position to permit fluid to flow from the fluid reservoir.
11. The implantable medical device of claim 10, wherein the output signal ranges between about +80 Volts and about +150 Volts.
12. The implantable medical device of claim 1, wherein the means for controllably energizing and deflecting the deflectable energy storing member and the means for recovering electric charge from the energy storing member are coupled to a suitable power source.

13. The implantable medical device of claim 12, wherein the power source is selected from the group consisting of an electrochemical cell, a battery, a plurality of electrochemical cells, a storage capacitor, a super-capacitor and an electrolytic capacitor.

14. An implantable means for infusing a fluid beneficial agent into a patient's body, comprising:

an hermetically sealed means for enclosing;

means for containing the fluid positioned at least partially within the enclosing means;

means for delivering the fluid into the patient's body;

controllable means for pumping, <sup>Ant</sup>the pumping means communicating with the fluid containing means and the means for delivering the fluid into a patient's body and causing the fluid to move from the fluid containing means into the means for delivering a fluid into the patient's body upon receiving a command actuating the pumping means; and

a valve assembly comprising deflectable means for storing electric energy and means for controllably energizing and deflecting the deflectable energy storing means by providing an output voltage and electric charge thereacross or therein, the valve assembly further comprising means for recovering the electric charge from the deflectable means for storing electric energy.

15. The implantable medical device of claim 14, wherein the means for recovering electric charge is operative when the output voltage provided across the deflectable energy storing means is switched off.

16. The implantable medical device of claim 14, wherein the energizing and deflecting means is electrically coupled to upper and lower surfaces of the deflectable energy storage means.

17. The implantable medical device of claim 14, wherein the deflectable means for storing energy is deflectable or moveable between a first non-energized position in which movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is blocked, and a second energized position in which the movement of the fluid from the reservoir into the means for delivering the fluid into the patient's body is permitted.

18. The implantable medical device of claim 14, wherein the deflectable energy storing means comprises a piezo-electric material.

19. The implantable medical device of claim 14, wherein the deflectable energy storing means comprises an electro-capacitive material.

20. The implantable medical device of claim 14, wherein the deflectable energy storing means comprises an electro-static material.

21. The implantable medical device of claim 14, wherein the deflectable energy storing means comprises a solenoid.

22. The implantable medical device of claim 14, wherein an integrated circuit comprising a driving circuit receives electrical current from a power source and transforms the current into an output signal appropriate to cause the deflectable energy storing means to deflect in response to the application of an electrical field thereto such that a sealing means moves into an open position to permit fluid to flow from the fluid containing means.

23. The implantable medical device of claim 22, wherein the output signal ranges between about +80 Volts and about +150 Volts.

24. The implantable medical device of claim 14, wherein the means for controllably energizing and deflecting the energy storing member and the means for recovering electric charge from the energy storing member are coupled to a suitable means for providing electrical power.

25. The implantable medical device of claim 24, wherein the means for providing electrical power is selected from the group consisting of an electrochemical cell, a battery, a plurality of electrochemical cells, a storage capacitor, a super-capacitor and an electrolytic capacitor.

26. A method of making an implantable means for infusing a fluid beneficial agent into a patient's body, the implantable means comprising an hermetically sealed means for enclosing, means for containing the fluid positioned at least partially within the enclosing means, means for delivering the fluid into the patient's body, controllable means for pumping, the pumping means communicating with the fluid containing means and the means for delivering the fluid into a patient's body and causing the fluid to move from the fluid containing means into the means for delivering a fluid into the patient's body upon receiving a command actuating the pumping means, and a valve assembly comprising deflectable means for storing electric energy and means for controllably energizing and deflecting the deflectable energy storing means by providing an output voltage and electric charge thereacross or therein, the valve assembly further comprising means for recovering the electric charge from the deflectable means for storing electric energy, the method comprising:

- (a) providing the means for enclosing;
- (b) providing the fluid containing means;
- (c) providing the means for delivering the fluid into the patient's body;

- (d) providing the means for pumping;
- (e) providing the valve assembly, and
- (f) operatively connecting the means for enclosing, the fluid containing means, the means for delivering the fluid into the patient's body, the pumping means and the safety valve assembly to one another.

27. A method of infusing a beneficial agent or drug into a patient with an implantable beneficial agent infusion device, the device comprising an hermetically sealed means for enclosing, means for containing the fluid positioned at least partially within the enclosing means, means for delivering the fluid into the patient's body, controllable means for pumping, the pumping means communicating with the fluid containing means and the means for delivering the fluid into a patient's body and causing the fluid to move from the fluid containing means into the means for delivering a fluid into the patient's body upon receiving a command actuating the pumping means, and a valve assembly comprising deflectable means for storing electric energy and means for controllably energizing and deflecting the deflectable energy storing means by providing an output voltage and electric charge thereacross or therein, the valve assembly further comprising means for recovering the electric charge from the deflectable means for storing electric energy, the method comprising:



- (a) energizing the deflectable energy storing means with at least one of electric charge and electric voltage and causing same to deflect from an un-energized position to an energized position;
- (b) causing at least a portion of the fluid contained in the fluid containing means to flow into the means for delivering the fluid into the patient's body in response to the energy storing means deflecting;
- (c) de-energizing the deflectable energy storing means and causing same to move to the un-energized position, and
- (c) recovering at least a portion of the electric charge from the deflectable energy storing means when the deflectable energy storing means returns to its un-energized position.